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Market Analysis and Planning Services (MAPS)

U.S. Information Services Industry-Specific Markets 1987-1992

Medical Sector

INPUT®

1280 Villa Street, Mountain View, CA 94041 (415) 961-3300

DECEMBER 1987

U.S. INFORMATION SERVICES INDUSTRY-SPECIFIC MARKETS 1987-1992

MEDICAL SECTOR

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Issues, Trends, and Events

I

Issues, Trends, and Events

A

Medical Industry Trends

The health care industry today is very different from that of three years ago. This is due in part to the implementation of prospective payments, known as Diagnosis-Related Groups (DRGs) for Medicare patients, versus the former cost-based payments system.

Because of the change in the reimbursement mechanism, the one really significant issue for health care in the 1980s is cost and the control of cost. Quality of care, once the only concern of health service providers, has been pushed into the background. Automated systems will play an important role in improving cost containment and institutional efficiency. Effective information systems are necessary for health care institutions to survive.

The pressure on medical institutions to become more efficient through automation continues to intensify. Competition for health care dollars has increased while the growth rate for medical spending for the overall industry has slowed in recent years.

According to the 1987 U.S. Industrial Outlook, health care expenditures will rise to $512 billion, a 10% increase over 1986. Health maintenance organizations (HMOs), home health agencies, and prepaid plans should continue their high growth rates, as shown in Exhibit I-1. Consolidation can be expected through mergers, acquisitions, and joint ventures among investor-owned hospitals, HMOs, and nursing homes. Hospital stays, which have been growing shorter in recent years, may stabilize or even increase slightly. (See Exhibit I-2) Overall, health care expenditures will continue to rise faster than the general inflation rate. Medical inflation has been gaining momentum since mid-1987.

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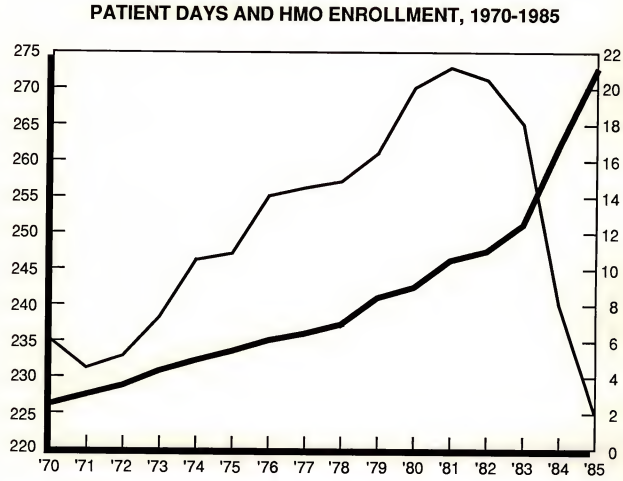
EXHIBIT I-1



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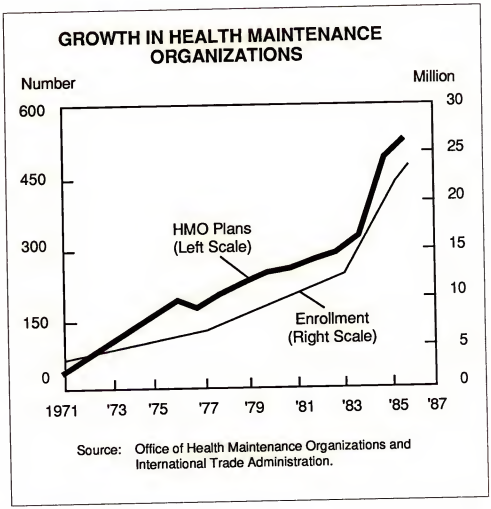

For the overall market, the major trends are:

- Health care's share of the total U.S. GNP has increased from 8.5% in 1972 to 11% in 1986.
- The rise of huge health care insurance management companies that may attain dramatic market power through vertical integration. Major investor-owned hospitals are becoming integrated. These changes have produced short-run profit margin depression.
- Decreasing demand for hospital services. From 37 million in 1982, admissions dropped to 32 million in 1986. Patient days were down 5% at AMI, 3% at HCA and 3% at Humana; these are the three largest hospital management companies.
- Medicare will boost its reimbursements by only 1% in 1988. Medicare absorbs 40% of U.S. medical payments.

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- Rapid proliferation of alternate sites for the delivery of health care; that is, the delivery of health services outside the costly hospital setting.
- The emergence of a home health care industry.
- Larger group practices.
- Dramatic increases in insurance premiums, as much as 20-30%, from major medical insurers.
- A rapidly growing Medicare population, 33 million by 1990, with commensurate greater use of health care facilities.
- Hospitals and group practices beginning to tie together, vying for market position. More aggressive advertising and sales promotion will result.
- HMO and PPO enrollments continuing to grow, making them major forces in the industry. HMOs have now captured about 10% of the available market, largely from private insurers. More than 26 million members belong to over 500 HMOs. By the mid 1990s half of all Americans may belong to HMOs or PPOs.
- Growing consumer strengths and drop in patient loyalty to specific physicians, leading to increased shopping for the best deal by patients and employers.
- A labor shortage (except physicians) occuring at almost every wage level. Nursing homes and acute care hospitals will be hurt most if this trend continues.

B

Hospitals

The major trends impacting hospitals are:

- The length of time patients stay in hospitals (patient days) has been decreasing, but, simultaneously, people are making more out-patient visits and greater use of nursing homes, home-care institutions, and emergency health care centers. In short, multi-modal delivery systems are evolving in the health care industry.
- In reaction to the changing competitive environment and continuing excess hospital capacity, hospitals and other health care providers are trying to transform themselves into integrated health care providers, with services ranging from out-patient, home care, and long-term care of the elderly, to mental health and drug abuse therapy.
- The consolidation and formation of multifacility providers forming larger, more centralized organizations, will require their own shared information systems.

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- There is a growing convergence of hospital and physician data processing needs. These two groups are becoming involved in cooperative ventures to preserve market share. Hospitals have an interest in networking physicians' offices into the hospital's patient care system, which increases the attractiveness to doctors of practicing at that hospital. The competitive advantage will go to hospitals that offer doctors the best access and ease of use in monitoring and tracking patients.

- As a consequence of the change in reimbursement for health care, many hospitals are experiencing decreased numbers of patients, shorter patient stays, and financial hardship. All have an increased need for information concerning their operations.

- Pressures to contain costs now have hospital administrators thinking in terms of efficiency. They're acting to reduce costs and increase patient volume.

Over the past three years, the federal government has been the primary force behind exerting pressure on hospitals to cut costs by:

- Establishing Diagnostic-Related Groups (DRGs), which shift reimbursement plans from cost-based to fixed cost accounting.

- Freezing reimbursements under Medicare in 1985.

- Reducing physical plant financing.

The fixed-reimbursement (DRG) plan continues to squeeze hospital profit margins. Hospitals have coped by sending patients home earlier, cutting labor costs, and delaying large capital equipment purchases. Operating more efficiently by having more control over the business operations has become a major goal. As a result, there is an increased awareness of the need to use information technology to cut costs and improve services.

In 1985 Medicare implemented its Prospective Payment System (PPS). Under PPS, reimbursements to hospitals and doctors for services rendered were frozen at the fiscal 1985 level, rather than allow the historical 5%-6% annual increase for 1986.

- The passage of the Gramm-Rudman Act suggests to hospital executives that the squeeze will intensify because there will be continued efforts to cut federal government expenditures on health care.

- Medicare peer review organizations are scrutinizing hospital admissions more closely than before PPS was in effect.

Increasing cost pressures on hospitals have prompted an effort to find ways of increasing efficiency and productivity. Computer automation is one solution to these cost issues.

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- New reimbursement systems make control of costs and knowledge of profitability of all hospital operations an important competitive weapon. It has led to high demand for productivity improvement and hospital case mix analysis applications, and also for integration of hospital information systems.

- Separate systems for finance, accounting, patient care, pharmacy, medical records, and radiology must be integrated.

- DRG-based reimbursements demand up-to-the-minute information on patient treatments and related costs. Online systems are now a requirement.

C

Physicians

During recent years, the number of medical group practices has increased substantially as a result of greater specialization in medical practice, lower operating costs associated with group practice, and greater patient acceptance. There are currently about 30,000 medical group practices in the U.S. The information processing requirements of group practices have increased due to two factors in particular:

- Increases in group practice size and patient volume.

- Increased patient use of third-party reimbursement programs, which require greater documentation of services provided.

Other information processing requirements include prompt and accurate completion of forms for third-party reimbursement, physician productivity measurement and analysis, and inventory control.

A physician surplus is occurring, with a significant over-supply of doctors projected by 1990. This will lead to increased competition and pricing pressures on physicians to deliver services at lower costs.

D

Definitions

Definitions of medical terms used are as follows:

- HMOs (Health Maintenance Organizations)—A patient pays a predetermined monthly fee for a range of health care services rather than paying for individual services rendered.

- PPOs (Preferred Provider Organizations)—These provide discount rate health care to plan members in exchange for prompt payment and a guaranteed patient base. PPOs are favored by employers with large local facilities who thus bypass third-party payors.

- DRGs (Diagnostic Related Groups)—This system catalogs illnesses requiring hospitalization and determines the length of stay and treat-

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ment guidelines for hospitals and doctors. The hospital receives the same payment for every patient in a given DRG, no matter what the actual length of the hospital stay and regardless of what real expenses are incurred. This is a departure from the previous method of providing a full range of patient services and receiving 100% reimbursement from the federal government.

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Market Forecasts

II Market Forecasts

A Introduction

The health care market is diverse. The information requirements of a 100-bed hospital are very different from those of a 500-bed hospital, and the requirements of a teaching institution are different from those of a community hospital.

The SIC (Standard Industrial Code) for this market is 80 (801-809). It includes Physicians, Dentists, Osteopaths, Health Practitioners, Nursing Homes, Hospitals, Medical and Dental Laboratories, Outpatient Care Facilities, and Health and Allied Services.

INPUT divides the medical sector into three segments: hospitals; physicians (which includes dentists, and group practices); and "other" medical organizations.

Demand for industry-specific medical segment applications will grow 16% annually through 1992, increasing from $2.8 billion in 1987 to $5.9 billion in 1992. For details see Exhibits II-1 through II-6 and Appendix Exhibits ME-1 through ME-4.

Appendix ME contains the forecast data base for each year from 1986 to 1992 for the total medical sector as well as separate forecasts for the hospital, physician, and "other" Medical sectors.

B Hospitals

The hospital information systems marketplace is very fragmented. There are approximately 160 vendors supplying the market; 135 of those generate less than $10 million each in annual revenue.

Underlying the increase in information services spending is the continued growth in hospital segment revenues. The growth will continue, but at slightly lower rates due to the continued effects of government cost containment programs. Between two and four percent of hospitals'

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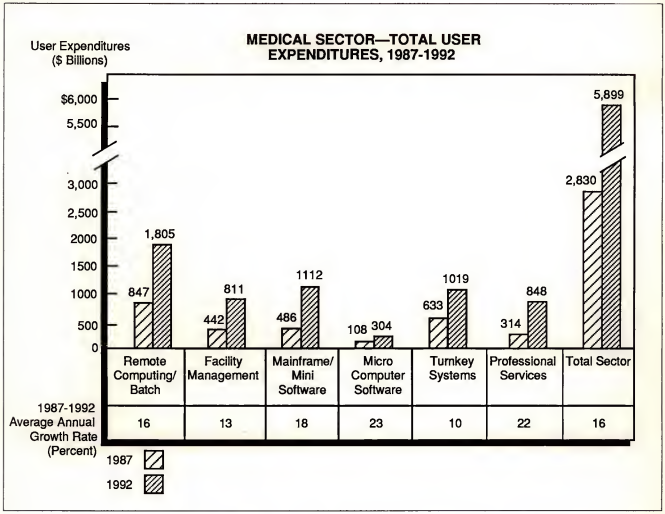
budgets are allocated to computer equipment. This should rise to four to six percent by 1990.

EXHIBIT II-1



The hospital segment is by far the largest of the three groups researched, with $2.2 billion in 1987 sales, as shown in Exhibit II-2 and II-3, and Appendix ME-2.

- Hospital information services spending will grow 16% annually through 1992, with 1992 expenditures totaling $4.7 billion.

- Mainframe/mini and microcomputer applications software for the hospital sector are expected to grow 17% and 22% respectively through 1992. Professional services expenditures will grow at a 21% annual rate.

The level of spending for hospital computer software and services will continue to increase for the five-year period, primarily because

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EXHIBIT II-2

MSVA-ME II-2

MEDICAL SECTOR MARKET FORECAST COMPARISON—INDUSTRY-SPECIFIC INFORMATION SERVICES, 1987-1992

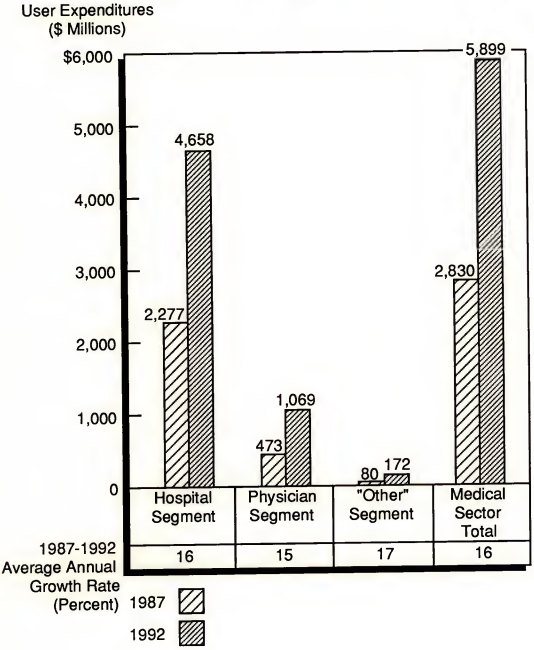

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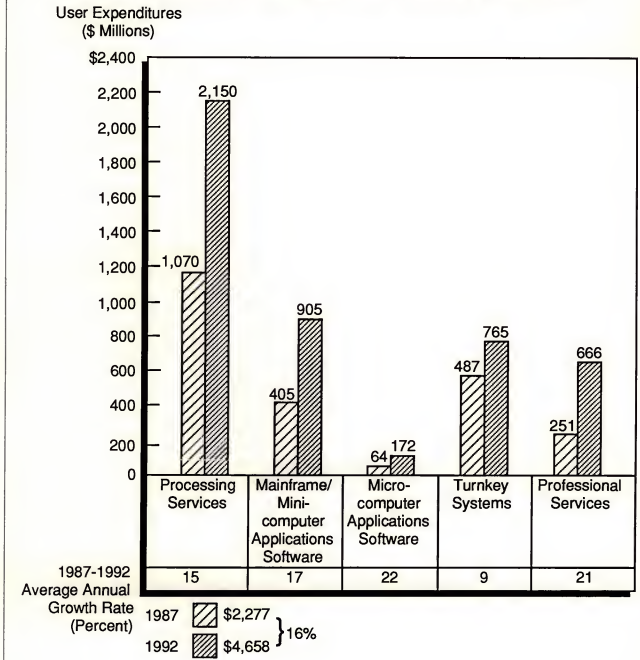
EXHIBIT II-3

HOSPITAL SEGMENT FORECAST— INDUSTRY-SPECIFIC INFORMATION SERVICES, 1987-1992



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- The information needs of hospitals are growing and changing dramatically due to changing reimbursement schemes and heightened competitive pressures.

- The technology and price/performance characteristics of computer systems are improving, thereby expanding the application of computers and enabling a much larger number of hospital personnel to use the systems effectively.

- There will continue to be a demand for labor-saving automation, especially in the people-intensive hospital environment, where much of that labor involves the handling of information multiple times by multiple users.

- Replacement of old, standalone financial applications with integrated financial systems will continue.

Hospital information systems are made up of four major components:

- Patient care systems (patient admitting, transfer, and discharge).

- Departmental systems (laboratory, pharmacy, radiology).

- Financial information (payroll, scheduling, purchasing, inventory, patient billing, and reimbursement).

- Decision support (budgeting and planning systems).

Medical, financial, and patient care systems dominate the industry today, constituting more than 80% of the revenue derived from hospitals. Laboratory and pharmacy functions follow at a distant third and fourth positions.

The financial systems business is primarily a replacement market (over 95% of hospitals have a financial system). Some hospitals are considering adding modules to their existing software packages, such as billing, payroll, inventory control, and DRG/case mix analysis.

The patient care systems market is still relatively unpenetrated (only about one-third of all hospitals have such systems) and offers major opportunities for hospital information service companies. Patient care systems typically incorporate order entry, results reporting, patient admissions, discharge and transfer; and nurse staffing activities.

- The increasing sophistication of vendors' offerings is making these applications more attractive to customers who have not yet adopted them; market penetration can be expected to increase substantially in the near future.

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Pharmacy and laboratory applications are the fastest growing; however, they form a relatively small part of hospital operations and will never approach the size of the other main applications.

Hospitals will be buying information systems as one of the most effective ways of containing costs under a rapidly changing regulatory environment.

C

Physicians

The physician segment, currently less than 17% of the total medical information systems market, will grow at a rate of 15%, as shown in Exhibit II-4 and Appendix Exhibit ME-3.

The physician market is highly fragmented. No single information services vendor represents more than 11% of total segment. CyCare Systems is the largest provider of information services to the Physician segment; another 300 companies are marketing software and services to this sub-industry.

According to figures published in the *Journal of the American Medical Association (JAMA)* and the *Journal of Family Practice*, approximately 380,000 doctors want to computerize their offices in the next few years. Currently, only about 14% of these offices are automated, primarily because most of the current systems are perceived as too difficult to use.

Decreasing hardware costs and increased availability of functional software will make turnkey systems and applications software especially attractive to currently unautomated offices.

The trend toward larger group practices at the expense of one- and two-person operations is aiding this growth. These larger organizations are more likely to have both the resources and the organizational need for automation.

Microcomputer-based turnkey systems and microcomputer software are major growth areas for the physician market. However, penetrating the physician market is considered very difficult. One reason is the difficulty in getting in to see a doctor to try to sell him/her on the system. Marketing expenses can thus be a problem. In addition, there are too many companies in the market already. Any new vendor of microcomputer software or turnkey systems will have to focus on a narrow niche.

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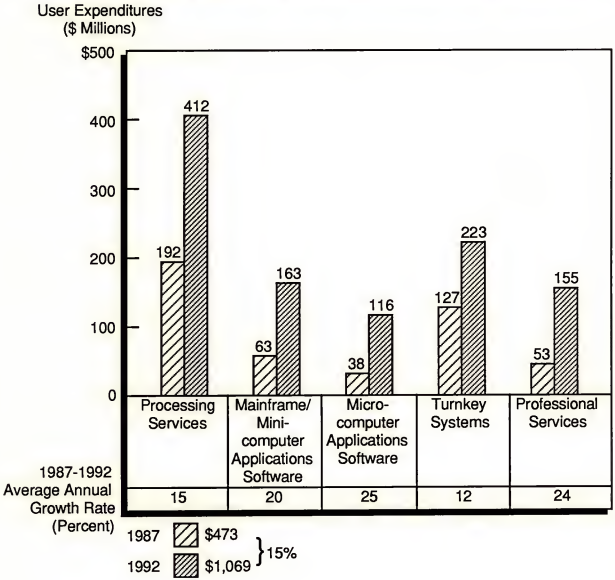
EXHIBIT II-4

PHYSICIAN SEGMENT FORECAST— INDUSTRY-SPECIFIC INFORMATION SERVICES, 1987-1992



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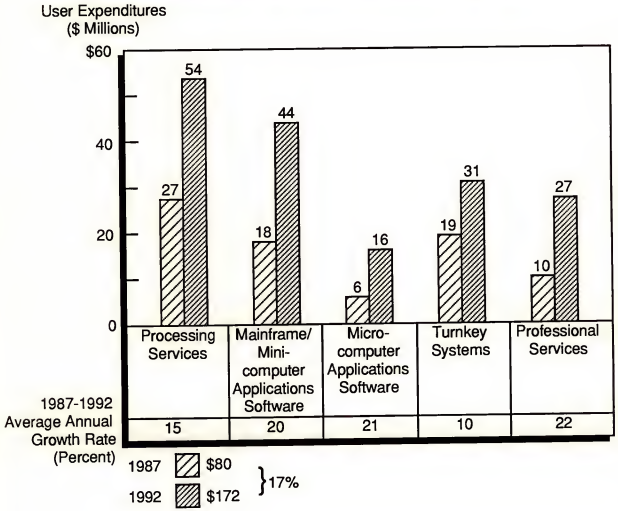
D

Other Medical Market

The Other Medical segment will grow at a rate of 17% a year, as shown in Exhibit II-5 and Appendix Exhibit ME-4. Included in this segment are outpatient clinics, laboratories, and alternate care facilities, such as nursing homes. The dramatic growth in alternate care facilities is fueling growth in this segment.

EXHIBIT II-5

OTHER MEDICAL SEGMENT FORECAST—
INDUSTRY-SPECIFIC INFORMATION SERVICES, 1987-1992



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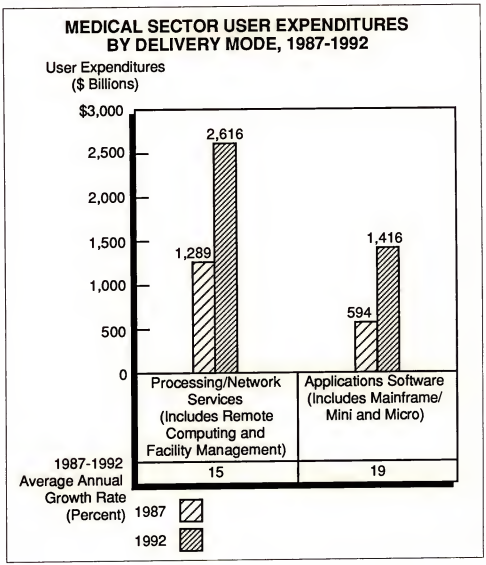
E

Processing Services

Shared systems will continue to thrive in offices recently introduced to automation, growing at an average annual growth rate of 15% over the five-year period, as shown in Exhibit II-6. However, as the users become more computer literate and aware of the benefits of computing, they will turn increasingly to in-house systems. Some vendors, like McDonnell Douglas Physician Systems, have developed in-house systems that link to hospital mainframes or minis. This covers both ends and secures the client relationship. Hospital batch data processing in highly competitive urban and suburban markets will most likely move toward online data processing. Rural hospital markets may remain well served by batch data processing for the foreseeable future.

The most significant factor in the continued, consistent growth of processing services facilities management is the difficulty hospitals have in staffing complete information systems departments.

EXHIBIT II-6



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F

Turnkey Systems

Turnkey vendors are competing for market share at the expense of processing services, and growing at the rate of 10% per year for the forecast period. The increased performance of computer systems (lower cost of hardware, increased performance of software) has resulted in a greater use of turnkey and in-house computer systems, with a resultant slower growth in processing services. However, many hospitals use a mixture of turnkey and RCS services.

Rapid growth is expected for turnkey systems developed for departmental applications (e.g., radiology, pharmacy, and medical records).

G

Software

Applications software will grow at a 19% average annual growth rate (AAGR) due to several factors:

- The continued increase in the installed base of hardware, allowing correspondingly greater opportunities for selling software.
- Greater willingness on the part of IS departments to buy packaged or customized software.
- Increased functionality of software, leading to greater customer acceptance and demand.
- Microcomputer-based software, from a smaller base is growing at 23%.

H

Professional Services

Professional services will grow at an AAGR of 22%. The increasing need to integrate hospital data processing and communications systems with those in physicians' offices, third-party reimbursers, and occupational health facilities is creating an increased demand for consulting and facility management services. In addition, the continued inability of hospitals to afford or attract an information services staff will lead to continued strong growth in the professional services market.

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Competitive Developments

III Competitive Developments

A Introduction

The medical information systems market is characterized by:

- The presence of large, well-established vendors.
- The continued consolidation of vendors, creating even larger competitors. Since over 1,600 VARs currently serve the medical markets, consolidation is inevitable.

The leading vendors of information services for the medical market are positioning themselves as full-line suppliers, selling a broad range of delivery modes to all the key markets. Vendors with a broad product line are rapidly increasing their market share as users shop for a single-source system.

A growing proliferation of PC-based products.

The market shares of the leading vendors in the medical sector are shown in Exhibit III-1.

The leaders in the medical financial information systems market are:

- Shared Medical Systems (SMS) and McDonnell Douglas Health Systems, leaders in processing services.
- HBO & Company, Travenol, System Associates, Computer Synergy, American Medical International, and Sentry Data, leaders in the turnkey systems market.
- Mediflex and Health Information Systems, leaders in the software market.

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EXHIBIT III-1

SELECTED VENDOR SHARES OF MEDICAL SECTOR INDUSTRY-SPECIFIC INFORMATION SERVICES, 1987 ($ Millions)

Vendor Name	Revenue ($ Millions)					Medical Sector Market Share (Percent)
	Processing	Applications Software	Turnkey Systems	Professional Services	Total	
Shared Medical Systems	280	20	80	20	400 [4]	14.1
McDonnell Douglas	137	17	68	28	250 [4]	8.8
HBO & Company [2]	38	11	88	38	175 [4]	6.2
IBM	-	65	70	-	135 [4]	4.8
Baxter Travenol [1]	15	38	7	70	130 [4]	4.6
CyCare Systems	40	4	21	-	65 [4]	2.3
Technicon	10	30	-	10	50	1.8
Systems Associates [3]	-	-	35	-	35	1.2
Cerner	-	-	26	-	26	0.9
Meditech	-	25	-	-	25	0.9
Health Data Sciences	-	-	15	-	15	0.5
Keane	8	4	-	-	12 [4]	0.4
IHC Health Services	-	-	8	-	8	0.3
Integrated Health Systems	-	-	5	-	5	0.2
Vendor Subtotal	528 (41%)	214 (36%)	423 (67%)	166 (53%)	1,331	47
All Other Vendors	761 (59%)	380 (64%)	210 (33%)	148 (47%)	1,499	53
Industry Total	1,289	594	633	314	2,830	100

1. Includes Compuserve
2. Includes Amherst Associates and Mediflex
3. Acquired by First Data Corp.
4. INPUT estmate

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The leaders in hospital management information systems are Amherst Associates (now a subsidiary of HBO & Company), SMS, Mediflex Systems Corporation (now a subsidiary of HBO & Company), and Ernst and Whinney.

The leaders in patient care systems include HBO & Company, SMS, Technicon Data Systems, McDonnell Douglas Health Systems, IBM, Electronic Data Systems (EDS), and CyCare Systems.

The leaders in laboratory systems are Citation Computer Systems, Control Data, Meditec, Community Health Computing, McDonnell Douglas, HBO, Laboratory Management Systems, and BSL Technology and Cerner Corp.

The leaders in pharmacy systems are Travenol, Continental Health Care Systems, Technicon, SMS, Digimedics, Medical Engineering, Hospital Data Services, and National Data Corp.

Most major hospitals over 300 beds already have automated systems, creating a replacement/upgrade market. Hospitals with less than 300 beds represent a more available marketplace for new systems.

B

Acquisitions

Acquisition activity in 1985 was the strongest in the history of the medical systems industry and the trend in mergers will continue. Many of the specialty companies that exist today will be bought out and incorporated into larger corporations. There are more than 160 firms selling computer systems to hospitals, and more firms will join together to survive in the competitive market.

- The trend will be toward a consolidation of vendors as hospitals turn increasingly toward single-source vendors who can supply the products and services required by an increasingly demanding marketplace.

Due to Medicare's Prospective Payment System (PPS), hospitals must buy better, more modern systems to merge clinical and financial data, classify their DRGs, and intensely analyze their case mix. Every hospital vendor will have to build or buy such capabilities, so more acquisitions are likely, especially of smaller companies who have successfully exploited the case mix/DRG niche.

Significant, recent mergers and acquisitions in the hospital information services industry include:

- HBO & Company acquired two vendors, Mediflex Systems ($99 million), and Amherst Associates ($66 million).

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- Baxter Travenol Laboratories acquired Compucare for $73 million.
- Shared Medical Systems acquired Computer Synergy for $16 million.
- CyCare purchased Management Systems of Wausau, and Medical Computer Systems.

C

Vendor Profiles

The following are profiles of the leading vendors in the medical market.

1. IBM

a. Products/Services

IBM has an extensive family of applications software products for the health care industry. The IBM Patient Care System, designed for intermediate and large hospitals, includes PCS-Patient Management, PCS-Patient Accounting, and PCS-Application Development System.

- The Patient Management application establishes a patient database at admissions that is then used by the other hospital applications.
- The Patient Accounting application, announced in 1984, automates the billing and collection procedures and is designed to enhance cash flow management and contain costs.
- The Application Development System is an application generator that produces applications from a set of building blocks.

b. Markets Served

Hospitals

c. Company Strategy

IBM plans to continue to be a leader in all aspects of providing needed information system solutions to all segments of the medical industry. IBM's approach is to offer flexible and integrated products, working with its network architecture to allow the hospital to integrate all information functions and requirements from a central database.

d. Recent Activities

The IBM Hospital Information System/36, announced in 1985, is designed for smaller hospitals. This system provides patient care, patient management, and patient accounting functions in hospitals with little or no data processing knowledge.

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IBM launched a joint study with General Electric Medical Systems to experiment with an approach to combine images and diagnostic reports with patient data taken from hospital and radiology information systems. They are working toward the timely integration of all diagnostic patient information—patient history, lab analysis, reports, and images—in order to increase efficiency and provide cost-effective diagnoses.

The formation of the Applications Software Division, in July, 1987, emphasizes IBM's commitment to increase its software revenues dramatically. The 6000-person group will focus, among other activities, on yet unspecified applications for specific market niches.

e. Future Direction

The future thrust involves extending the capabilities of the integrated network. IBM plans to expand its hospital information system to include hardware, software, and communication links to all departments within a hospital that have a need to pass data to the host or to one another, to the staff physician's office or home, to organizations representing alternate delivery systems, to insurance companies, and to medical databases.

2. McDonnell Douglas Health Systems Company (MDHSC)

a. Products/Services

McDonnell Douglas Health Systems provides turnkey systems, software and processing services, mini and mainframe-based systems. MDHSC serves more than 1,500 hospitals as well as 25,000 physicians' offices.

b. Markets Served

All segments of the medical industry: hospitals, (radiology, nursing, pharmacy, operating room, laboratory, patient care, financials, etc.), data communications systems, outpatient financials, strategic planning for case mix management, medical records, and physician office automation.

c. Company Strategy

MDHSC is one of five divisions of McDonnell Douglas Information Systems Group. This company, formed in 1985, focuses on information services to the health care market; about 21% of ISG revenues come from MDHSC.

MDHSC, through its acquisitions and reorganization, serves all segments of the medical market and is one of the leading vendors.

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d. Recent Activities

MDHSC is forming partnerships with hospitals through its "alliance" program, which will allow hospitals to market MDHSC's IBM PC-based office automation applications to individual or group practices. The program is designed to complement hospitals' strategic marketing objectives.

MDHSC has four companies in its span of control:

- McDonnell Douglas Health Information Systems Company focuses on hospitals. Over 1,500 hospitals, 20% of the U.S. market, use one or more MDHIS systems.
- McDonnell Douglas Physician Systems Company offers systems to physicians, group practices, medical schools and HMOs. It serves more than 25,000 physicians nationwide.
- Vitek Systems' products identify microbiological organisms and the antibodies and dosages most likely to control their growth.
- Bactomatic's product is marketed to industrial laboratories to help technicians get faster and more accurate test results.

MDHSC has entered into a joint marketing agreement with Florida-based Tingley systems. Tingley will computerize management systems for HMOs and PPOs using the Pick operating system.

e. Future Direction

The company plans to integrate financial and patient care systems with clinical information. It offers a multiple-delivery solution: timesharing, turnkey systems (mini and mainframe) and applications software. MDHSC expects that by 1990, 75% of its business will come from turnkey systems.

3. Shared Medical Systems (SMS)

a. Products/Services

SMS offers multiple delivery options: remote computing services, turnkey systems, and, to a lesser degree, software products and professional services. SMS offers broad product lines on both IBM and DEC VAX systems.

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b. Markets Served

Hospitals, group practices, and clinics. SMS serves more than 700 hospitals, reflecting a 14% market share. SMS is the market leader in most medical market segments, and the largest vendor in terms of revenue.

c. Company Strategy

SMS serves hospitals with more than 100 beds, placing its system at the center of a network linking hospitals, medicare organizations, insurance companies, government agencies, and hospital supply companies.

SMS, initially a successful provider of remote computing services to hospitals, physicians, and other health care providers, has steadily expanded its product line to include a comprehensive range of services—financial, administrative, patient care, and decision support systems—all offered on a remote computing basis, an in-house turnkey approach, or a combination of the two.

SMS is well positioned to take advantage of the market opportunities posed by PPS because it had an integrated database management system that was precisely the type hospitals needed to implement case mix management.

SMS offers the most complete product line in the medical data processing market.

d. Recent Activities

The company has expanded the role of PCs in its hospital information networks through such applications as nurse staffing and medicare cost reporting.

SMS discontinued operations in Japan taking a $20 million charge against income, due to difficulty in seeing a clear-cut path to profits in the Japanese hospital market.

SMS introduced a PC-based medical record workstation that supplies traditional workstation capabilities.

SMS opened new offices in the South and Midwest for its Practice Management and Consulting Services operation, which consults to physicians.

SMS introduced a broadened facilities management program in 1987. Introduced in 1986 were new or enhanced radiology, pharmacy and laboratory applications. SMS's new Materials Management application accommodates multiple inventory and receiving locations.

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SMS has begun to experiment with satellite transmission as the sole means of contact with its remote processing clients.

- An important product, introduced in 1983, is the INDEPENDENCE System, a standalone integrated financial management and patient care system designed to run on IBM mainframes. This product gives the company the capability of offering hospitals a total in-house solution to their needs. Delays in installing this system in 1986 and 1987 impacted revenues and generated some negative publicity.

- Another new product is SPIRIT, a turnkey system offering integrated patient care and financial software running on DEC VAX hardware.

- SMS invests heavily in R&D; $24 million in 1986 was allocated to this area.

e. Future Direction

SMS sees an active market for replacement of outdated financial systems. Its role in the center of a large, integrated network may become a reality since data communications is becoming a driving force in the hospital data processing market. INPUT expects SMS to market more single- and multi-user microcomputer systems, to reach smaller customers, and reduce delivery costs.

SMS's size, stability, focus, and financial resources will enable it to devote considerable resources to research and development, allowing it to introduce new products as the technology becomes available.

4. Baxter Travenol Laboratories, Inc.

a. Products/Services

Baxter Travenol Laboratories offers software, facilities management, professional services, and turnkey systems.

b. Markets Served

Travenol Healthcare Information Services comprises five divisions which serve different segments of the marketplace. These divisions are:

- JS/DATA, with offerings for the small hospital market (under 200 beds) based on the IBM System/36.

- Dynamic Control, which serves the mid-size market of 200-500 beds, running on the IBM System/38.

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- Integrated Healthcare Technologies, the combined offerings of Stony Brook Systems and PCI divisions, provides hospital information systems solutions to large institutions, primarily over 500 beds, on the IBM 43XX and 30XX series.

- Compucare provides system integration and facilities management services across the hospital market, as well as Data General-based HMO and HIS turnkey systems for the mid-sized hospital.

- Physician Services offers management systems for the physician's office, clinic, and alternate site facilities based on the IBM PC and System/36.

With close to 500 hospital and 350 physician clients, Travenol is a leader in each of the market segments it serves. It is the fourth largest information services provider to the health care industry in terms of the number of clients served.

c. Recent Activities

Baxter Travenol Laboratories acquired Compucare for $73 million in 1985. The acquisition make Baxter, which had been building its information services business group for the past few years, one of the largest companies in information systems for the health care industry.

The combination of Baxter's consulting abilities and Compucare's facilities management abilities should be a strong one. The wide scope of Baxter's information systems products can now be deepened by the option of facilities management or internal operations consulting before and after the sale.

Baxter has launched an electronic order-entry system, that enables hospitals to purchase products more easily and quickly. GEISCO's EDI Express is the vehicle used.

d. Future Direction

With numerous divisions, continued investment in R&D, and a long-term strategy of becoming the leader in the health care market, Baxter Travenol plans to maintain its position as one of the leading vendors.

5. Compucare, Inc. (Subsidiary of Baxter Travenol Laboratories, Inc.)

a. Products/Services

Compucare provides professional services, turnkey systems, and applications software. Professional services account for about 65% of Compucare revenues.

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b. Markets Served

Hospitals and physicians.

c. Company Strategy

The company plays a key role in Baxter Travenol Corporation's strategy to be a full-line supplier to the fragmented health care market.

d. Recent Activities

Compucare entered the physician office systems market in 1984. Compucare was acquired by Baxter Travenol in 1985.

e. Future Direction

Baxter Travenol is likely to use Compucare as a vehicle to attack the financial and patient care segments of the hospital systems market. Compucare is developing an integrated clinical/fiscal system, based on a single computer system or a tightly coupled computer network with a single data base.

6. HBO & Company

a. Products/Services

HBO offers turnkey systems, packaged software, facilities management, and remote processing.

b. Markets Served

Hospitals (patient care, finance and administration, decision support, and clinical department management). HBO began as a one-product company delivering minicomputer-based patient information systems, and evolved to a full-service company providing a variety of systems and services. They now serve over 1,200 clients.

c. Company Strategy

HBO & Company views the hospital as the focal point of future health care delivery systems. The company intends to offer patient, departmental, financial, and decision support information systems as well as management consulting and facilities management services.

d. Recent Activities

HBO & Company acquired two sizeable medical information services providers: Amherst Associates, a leading medical industry consulting

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firm, and Mediflex, a supplier of software products and facilities management and decision support services.

- Amherst Associates provides planning and financial modeling processing services, microcomputer software, turnkey systems, and management consulting to hospitals and other health organizations.

- Mediflex Systems provides professional services, facility management, processing services, and IBM-based applications software products, primarily to hospitals.

The absorption of these two companies placed a strain on 1986 operations, with revenues falling from $188 million in 1985, to $154 million in 1986. In 1987, revenues rebounded to $175 million.

HBO has formed a three-vendor partnership, to integrate its hospital information system with general financial software from Global Software and human resource management software from Integral Systems.

HBO for the first time has "unbundled" its pricing for support and maintenance of software.

e. Future Direction

HBO & Company will place increased emphasis on recurring support and maintenance revenues, systems for home care agencies, and opportunities in the international marketplace.

7. System Associates (SA)

a. Products/Services

Systems Associates provides turnkey systems.

b. Markets Served

The systems are marketed under the SAINT trademark and consist of minicomputer-based networks designed specifically for hospitals. SAINT systems are targeted for acute care hospitals with between 50 and 300 beds. (According to System Associates, this represents 59% of the total U.S. client marketplace.) SA also targets extended care facilities and kidney dialysis centers.

c. Company Strategy

System Associates aims to be a full service organization providing single vendor responsibility for virtually all aspects of its clients' data processing needs.

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An agreement with Curtis 1000 Information Systems allows hospitals to link physicians' offices to the SAINT system at a nearby hospital.

d. Recent Activities

Systems Associates was acquired by First Data Resources in November, 1986 for $34 million.

8. CyCare Systems

a. Products/Services

Processing services and turnkey systems to ambulatory care facilities, medical group practices, HMOs, and medical schools. Professional services to large group practices, practice management services to hospital-based physicians.

b. Markets Served

Physicians and medical group practices, ambulatory care facilities, HMOs, and medical schools. CyCare Systems sells software for the management of patient information, scheduling, billing and insurance, and administrative functions. CyCare serves a total of 1,500 clients.

c. Company Strategy

CyCare System's strategy is to provide a broad range of services and systems to meet the expanding needs of the market and to increase geographic market penetration by expansion of direct sales coverage. The company is currently the largest provider of information processing services and systems to physicians and medical group practices.

d. Recent Activities

During 1986, CyCare acquired Medical Management Systems of Shreveport, LA, and the assets and business of The Physicians Bookkeeper, Detroit.

CyCare acquired the rights to a totally integrated hospital patient care and accounting system from Caraway Hospitals in Birmingham, AL. The renamed CyCare 1000 system will be moved to the IBM MVX/XA architecture, allowing it to serve as many as 4,000 terminals.

The CyCare 900 turnkey system was announced in 1986, geared for large medical group practices using IBM hardware. CyCare is experiencing good market penetration with the 900.

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- CyCare allocated $3 million to product development in 1986.

- Cycare has executed an exclusive agreement with Boston Software Systems to market an electonic interface product to the health care market. CyNet will link physicians' offices with hospital computers and their various departmental systems.

e. Future Direction

CyCare has established a small systems group to keep focused on small group practices.

CyCare will continue to expand its product line with networking of HMOs to other medical delivery sites.

CyCare plans to expand its market penetration through joint ventures. CyCare recently entered into a marketing agreement with Computer Associates to combine its financial management software with CyCare's hospital system.

9. Technicon Data Systems

a. Products/Services

Technicon provides processing services, software products, turnkey systems, and professional services.

b. Markets Served

Hospitals, physicians, clinics, medical groups.

Technicon offers its Medical Information System, a comprehensive, patient care system. The Patient Accounting System tracks patient bills and insurance forms, and collection activity.

The Technicon Medical Data System for physician's offices offers links to Technicon's Hospital Information System, tying doctors or clinics to each other or to hospitalized patients.

c. Recent Activity

Technicon and MSA have entered into an innovative agreement to jointly offer a fully integrated hospital information system, based on large IBM computers. MSA's Information Expert will be the tool by which the two vendors' applications are integrated.

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10. MEDITECH

a. Products/Services

Meditech provides turnkey systems, applications software, remote computing, and facility management. Key products are patient care, clinical, and financial applications software.

b. Markets Served

Hospitals, private laboratories and prepaid health plans. 200 institutions, mainly hospitals, are Meditech clients.

c. Company Strategy

Meditech's line of application modules for hospital care, clinical, and financial operations can be used independently or as part of an integrated system, and can interface with applications from other vendors.

Meditech licenses OEMs and distributors to use its proprietary operating system and programming language. MIIS/MAGIC was developed as an enhancement to MUMPS, and has over 2,000 end users. Not all of them are in the medical field.

11. Keane, Inc.

a. Products/Services

Keane provides custom and packaged software, professional services and facility management. KeaMed Hospital Systems division markets a family of modular and integrated financial, patient care, and ancillary department systems for hospitals. Its products include the Hospital Information System/36 with integrated support programs, and a family of modular hospital systems marketed as Worry-Free Software. Software and turnkey systems are based on the IBM System 36 and 38, and the Wang VS.

b. Markets Served

Hospitals. KeaMed has about 40 systems installed in hospitals with 50 to 400 beds.

c. Recent Activities

Keane cancelled its VAR agreement with IBM in 1986, to provide greater flexibility in dealing with IBM's sales organization. This reduced sales volume by nearly one million in the near term.

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KeaMed introduced the Hospital Information System/36 (HIS/36) in 1985. The system was developed by IBM with the cooperation of Keane. Sales of the system are a joint effort between IBM and Keane.

- The HIS/36 consists of a patient registration, billing, and receivables module; a communications and results reporting module; and a medical records module.

During 1987, sales of Keane's hospital software were adversely affected by the uncertain environment in the health care industry, and the elongated sales cycle for HIS.

Keane recently combined two hospital product groups, one using IBM System/36, one using System/38, into a single organization, to achieve cost reductions. Kean's application software group now targets health care markets exclusively.

d. Future Direction

Keane will concentrate its application marketing efforts on hospitals with 50 to 400 beds. Keane will work closely with IBM's and Wang's direct sales organizations.

12. Other Vendor Activities

AT&T has introduced a turnkey system for hospitals, based on 3B computers and software from Dallas-based Infostat.

Decision support systems for hospitals are offered by Systemetrics (McGraw-Hill) and Ernst Whinney.

Health Data Sciences sells comprehensive hospital information systems and has raised over $16 million in venture capital to finance its growth. The HDS system utilizes bedside terminals to record all patient information electronically.

NCR, AT&T and others are working on a "computerized clipboard" for nurses to carry on their rounds.

NCR offers the Med-net HIS, covering financial, patient care, and administrative applications.

IHC affiliate, Health Services, offers a complete HIS on IBM System/38, targeted toward 100-600 bed hospitals. IHC is an IBM IMAP, but also markets through a direct sales force. Prices average $250,000. IHC currently has about 100 users.

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Integrated Health Systems is also an IBM IMAP, using System/38, and offering a turnkey system for patient accounting, patient care, and financial systems. Software prices average $150,000.

Datacare offers total integration of patient care, patient accounting, and Global's general accounting system on IBM mainframes. The system is geared to 225-1000 bed hospitals and hospital chains.

TDS Corporation offers large hospitals and multi-groups a comprehensive HIS on the IBM mainframes. TDS' patient care system automates over 80% of the patient's chart.

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IV

Information Systems Department Outlook

IV

Information Systems Department Outlook

A

Major Issues

The underlying business pressures that have been facing the medical industry for the past few years continue in 1987 and 1988. Increased focus on costs, quality of care and competition within the health care area all continue to drive major changes in the management processes of this sector.

- These changes have created numerous and difficult challenges for the Information Systems departments as they strive to bring automation to all areas of health care including many that have not been previously automated .

- INPUT has observed that, in 1987, the medical industry has moved from talking of strategic planning and marketing to actual implementation of new and expanded services; many of which require new and creative information management solutions.

While IS remains under pressure to contain costs, it is also receiving the focus afforded it in other industries. IS is being recognized as and being asked to perform like a strategic contributor. For example:

- It is often viewed as the only means to help hospital management deal with the federal government's DRG-based payments program. This is an area in which success by the hospital industry has brought additional and more stringent federal reporting requirements.

- It is being drawn into and becoming a significant factor in the implementation of a cohesive marketing strategy.

- It is a focal point for the evolution to cost and profit-based management processes.

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1. Driving Forces

The dominant driving force in the medical and health care industry remains cost of delivery. Increasing costs in the face of growing competition and public and governmental pressure has drastically changed the focus of medical industry management and with it, it's information systems organizations. Being able to respond to changing government regulations, and service offerings, while maintaining cost effective delivery of services is a constant challenge for IS management.

Government regulations continue to be a major force in determining the priorities of medical sector IS programs. The accounting and reporting systems required to meet regulatory needs are large, complex, and undergoing frequent change. Because of this they are a major draw on IS resources. There is a need both for new applications and for ongoing maintenance and enhancement.

Mergers and acquisitions of acute-care hospitals, specialized clinics, nursing homes, and laboratories are bringing a new dimension to the IS challenge. In many instances, IS is finding a need to centralize operations and standardize application software to gain the necessary efficiencies and cost reductions.

Competition and the related marketing of services remains a strong influence. The mid-level hospital must strive to differentiate itself to maintain its position while the large institution must meet its competitor head-on with quality, low cost care. The large hospital is using specialized services such as helicopter and emergency trauma service to build relationships with small city hospitals as a means to underwrite the cost of the service and improve the flow of patients to specialized services.

These driving forces are summarized in Exhibit IV-1.

EXHIBIT IV-1

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2. Issues and Objectives

Exhibit IV-2 summarizes the primary challenges for IS management in the medical sector. These challenges are not significantly unchanged from last year's report. The major changes are:

- The need to support end user computing needs has been dropped, not because the challenge has gone away; but because it is an objective for IS in all industries and one that is seeing measurable progress.

- The objective of automating laboratory systems has been added. This is a need driven by government regulation, cost containment and it has remained an area relatively unaddressed by IS in the past. This is also a major issue in the pharmaceutical industry where the challenge to track the testing of new drugs is essential.

The principle IS issue and challenge remains to organize the information of the medical institution to meet cost effective management and external reporting requirements. Meeting this challenge is driving IS management to further integrate patient, accounting and operating (purchasing and inventory) systems.

The availability of software packages to address the DRG-based accounting requirements is helping. However, hospitals must decide whether to buy the solution or continue to develop an in-house, perhaps more integrated solution.

The focus on patient tracking and administrative systems continues as a key objective. These systems can contribute to the overall cost effectiveness of the organization and simplify the interfaces with outsiders such as the insurance industry and the regulatory agencies. The underlying issues are confidentiality of patient information and the interfaces with supporting patient systems such as the pharmacy and laboratory administrative systems.

There remains within this sector, in particular within hospital management, some processes that are still administered manually. These continue to offer IS an opportunity to contribute. In 1987 one area receiving much attention is laboratory testing.

The regulatory issue continues to place significant pressure on the administrator and IS. To satisfy the reporting requirements in a timely fashion, end users are performing a growing part of the reporting process and are demanding significant support.

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EXHIBIT IV-2

MEDICAL
ISSUES AND OBJECTIVES

Issue \ Objective	Cost Containment	Implement On-Line Accounting for Regulatory Reporting	Improve Confidentiality of Patient Information	Attract Physicians with Technology Innovation	Implement Integrated Patient Care Systems	Implement Automated Laboratory Systems
Cost Pressure	High	Does Not Apply	Medium	Does Not Apply	Medium	Medium
More-Complex Accounting Systems	Medium	Does Not Apply	High	Does Not Apply	Medium	Low
Centralized Patient Information	Medium	High	Medium	Medium	Medium	Medium
Provide Automated Tools to Assist/Attract Physicians	Does Not Apply	Medium	Medium	High	Medium	Medium
Automated Manual Processes to Improve Productivity	Medium	Does Not Apply	Low	Low	High	High
Regulatory Reporting Compliance	Medium	Low	Medium	Low	Medium	Medium

3. Impact of New Technology

Exhibit IV-3 lists those areas of computing technology which currently have, or are likely to have, a direct impact on the medical sector.

End user computing developed relatively recently within the medical sector. It continues to be a focal point, now supported by organized and growing support programs.

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EXHIBIT IV-3

MEDICAL INDUSTRY AREAS OF INTEREST—NEW TECHNOLOGY

- End-User Computing
- Networking with Outside Organizations
- Scientific Computing
- Medical Technology
- Distributed and Departmental Systems
- LANs
- Relational Data Base Management Systems
- Voice/Data Integration

Distributed and departmental systems are a common and key element of hospital IS strategies.

- Many departments have existing processors used for scientific applications. These provide an opportunity for connection to office automation and electronic mail networks.

- The end user is becoming involved with the local processing capability and, as in other industries, beginning to develop his own applications. This trend, which will develop over the next three years, will lead to a control problem for IS management.

There is a growing interest in connecting information systems with outside organizations including affiliated supporting clients, private physician offices, claims processors, and others. This will create new telecommunications challenges for IS while providing additional opportunities to contribute to overall cost effectiveness.

Hospitals continue to have a high and pervasive interest in new scientific technology for medicine. Today much of that technology is information systems related that offers IS an opportunity to contribute directly to the

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quality of health care. Senior management needs to draw IS management into this area both to assure the compatibility of the medical related technology and to gain the insights of IS.

Relational data base technology is gaining interest in the medical sector. However, less than 25% of those surveyed were planning to implement this technology in the near term. This was true for small, medium, and large hospitals.

LAN technology has a high level of interest for this sector, perhaps due to the existence of many professional users and departmental processors. However, the lack of standards is delaying progress. IS will need to take a proactive position to move this technology forward.

The merging of voice and data communications remains a low priority (less than 10% of respondents). A principle reason is that many medical sector organizations are either in a single location or located close to one another.

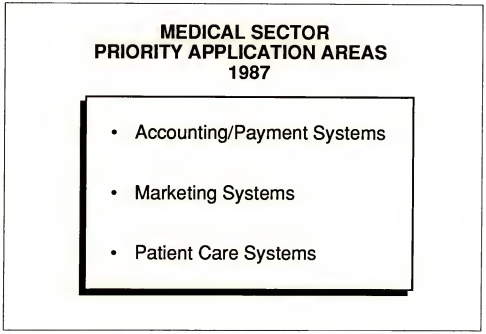
B

New Applications

1. Application Areas

The focus of application development programs within this industry is in the areas listed in Exhibit IV-4.

EXHIBIT IV-4



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a. Accounting/Payment Systems

Accounting remains the major application area in the medical field.

- Accounting systems must be tailored to meet the DRG reporting and payment requirements imposed by the federal government. Although the requirement for these systems became effective in October, 1986, the lack, until recently, of third party software has hampered the rate of installation.

- The goal to improve payment systems and the communication between payment sources (insurance companies and governmental agencies) is generating interest in electronic data interchange (EDI) technology.

- INPUT noted a number of sites converting from Motorola/Four Phase Systems to DEC- and IBM-based integrated financial systems due to the age of these systems and concern about their long-term viability.

b. Marketing Systems

Marketing is becoming the medical "buzzword" and is the area with the greatest unmet information needs. Medical organizations are now applying marketing techniques to more effectively compete. Access to demographic, utilization, and profit margin (by type of service) information has become essential.

- Hospitals are trying to better understand the demographics of their patient base and want to learn how to better serve physicians who refer patients as well as those on staff. Application software correlating demographic information with patient profiles, physician data, and facility utilization is an area of new focus. However, up-to-date accounting software should be installed first as the data required for marketing systems is provided from these financial systems.

- Marketing information is also important to blood banks and specialized clinics where services are now aggressively marketed to affiliated hospitals and physicians. Understanding and "marketing" to the limited source of blood donors is also an area of importance. Blood banks are investigating automated testing and inventory tracking systems to reduce costs and better manage their fragile product.

c. Patient Care Systems

Patient care systems continue to play an important role and demand a significant portion of IS development resources. This has been an area of opportunity for third-party software vendors, but seems to remain a priority of the in-house development staff. Rightly or wrongly, the orientation to patient information tracking seems to vary significantly across the industry, making it difficult to purchase a system.

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d. Other Application Areas

Other areas of priority include pharmacy, radiology, and materials management, including a growing use of personal computer-based production systems in laboratories, supply rooms, and on the hospital floor to track supplies and patient care.

A final factor in the application area is the move towards merger and acquisition. This is causing a trend for some centralization of information processing to gain integration of accounting processes and access to economies of scale in processing.

2. Development Resource Allocation

In 1987, nearly half of large medical organizations began to move from custom development to the purchase of third-party software. These choices were dictated by changing economies of scale, the true cost of software enhancements and maintenance, the aging of existing systems, and the recent availability of more complete, integrated application software. These new systems are being developed by larger, financially stable vendors. In the past third-party suppliers were smaller and less dependable.

The industry emphasis on external development resources, reflected in Exhibit IV-5, has always been significant. Historically, due to the relatively smaller size of the health care industry IS functions and the specialized nature of many of the applications, there has been a dependence on outside development companies. Many of these firms are now moving to provide more complete packaged solutions versus the customized variety. This trend is projected to continue.

C

Budget Analysis

Exhibit IV-6 shows the distribution of IS budgets for those organizations interviewed, including the projected change by budget category in 1988 over 1987. The forecasted changes are modest in all categories.

IS budgets for medical organizations (including hospitals, physician practices, blood banks and independent laboratories) are expected to grow by a modest 1.2% in 1988 over 1987. Cost containment continues to pressure the IS budget in spite of the conflicting pressure for additional systems.

Planned expenditures in hardware exceed those expected in software and services. Hardware expenditures are rising because installed CPUs are at capacity and new larger integrated applications are demanding more processing power and storage.

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EXHIBIT IV-5

SOURCE OF DEVELOPMENT RESOURCES
(Major New Applications)

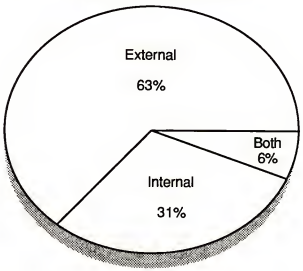

EXHIBIT IV-6

1987 BUDGET DISTRIBUTION AND 1987/1988 CHANGES IN THE MEDICAL SECTOR

BUDGET CATEGORY	1987 PERCENT OF I.S. BUDGET	1987-1988 EXPECTED BUDGET GROWTH
Personnel Salaries and Fringes	39.6	3.2
Mainframe Processors	7.7	2.9
Minicomputers	5.6	1.0
Microcomputers	2.5	3.6
Mass Storage Devices	3.4	2.7
Other Hardware	7.9	(1.5)
Total Hardware	27.1	1.3
Data Communications	8.3	2.1
External Software	10.3	3.4
Professional Services	0.9	0.9
Turnkey Systems	2.7	0.4
Software Maintenance	1.5	1.3
Hardware Maintenance	5.4	(2.8)
Outside Processing Services	0.1	0.0
Other	4.1	(2.2)
Total Software and Services	33.3	0.9
Grand Total	100	1.2

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Within the hardware budget, the expenditures for microcomputers and mainframes are expected to grow faster than those for minicomputers. Consolidation among hospitals is one force affecting the growth in mainframe installations. When two or more medium sized hospitals merge, two minicomputers are replaced by a mainframe to gain economies of personnel and consolidation of applications and data bases.

The 10.3% in 1987 budget allocations to external software supports the comments earlier about the use of outside developers and package software. The more typical allocation in other industries is about 6%.

Exhibit IV-7 shows the distribution of the magnitude and rate of budget change projected within the industry.

- The percentage of IS budgets projected to be higher in 1988 is only 41% compared to 79% in INPUT's 1987's projection. This decline can be attributed to continued cost containment programs and to a focus on implementation versus launching major new programs.

- Of those budgets that are growing, 57% are growing at a lower rate than last year's projection, again emphasizing the focus on costs.

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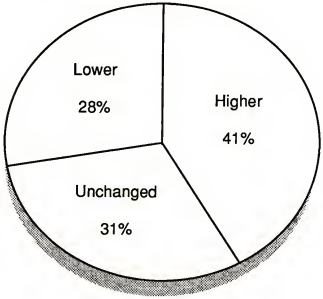
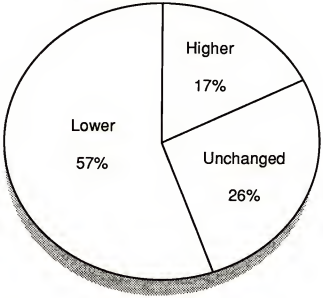
EXHIBIT IV-7

MEDICAL SECTOR BUDGET CHANGE ACTIVITY

Comparison of 1988 and 1987 IS Budgets
(Percent of Respondents)



Comparison of Changes in Growth Rates,
1988 - 1987
(Percent of Respondents)



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New Opportunities

V New Opportunities

A Integrated Systems

Over the next 10 years, most hospitals will be installing totally integrated financial, clinical, and data communications systems to replace their fragmented, interfaced information processing systems. "Mission Critical" systems for nursing, laboratory, radiology, pharmacy and other clinical departments will be integrated into financial and patient care systems.

- Hospitals do not want a wide variety of different systems; they want systems that tie together all their needs and allow them to cope with the informational needs of regulatory agencies and the intensely competitive environment they face.

Old computer systems primarily monitored financial information. However, with the advent of Prospective Payment Systems, clinical information has taken a much more important role. Whereas these systems were separate, they must now be integrated.

Point-of-case information systems will use bedside terminals and workstations to immediately update the patient data base and allow rapid access by physicians and nurses.

Hospitals are going to need systems that can account for what it costs them to deliver various services, rather than what they paid for them. Most information systems which exist today are not designed to capture costs on a direct basis.

- The technology involved requires an integrated clinical/fiscal system—one computer system or a tightly coupled network and one data base, with everything happening to a patient logged in real time. However, the development of these integrated systems will lead to longer sales cycles. Moreover, because of their complexity, these systems will spur the growth of the professional services market.

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Hospitals can no longer function with separate systems for financial operations, patient care, nursing management, laboratory management, medical records, etc. With separate systems, the same information must be re-entered in each subsystem, resulting in greater error rates and wasted manpower. A single, integrated system would boost efficiency and increase the quality of health care provided.

- Future systems will require the integration of inpatient and outpatient systems.

The computerization of clinical information systems is a critical area for the health care industry. Traditionally, clinical information is segment into independent domains—laboratory, pharmacy, nursing, radiology, etc. As long as clinical information is segmented into these domains, timely action based on this information is impossible. Hospitals face the challenge of integrating clinical information systems with cost information systems.

B

Networking

In the future, networking capabilities of computer systems will become even more effective and far reaching. Systems must go beyond linking communications databases; they must combine financial information with the ability to make faster, cost-effective patient care decisions.

The ability of a doctor's office to tie into the hospital's inpatient system will enable a physician to monitor patient progress and reduce the amount of time spent calling orders to the hospital.

- Hospitals are beginning to install PCs in physicians' offices, thus improving the efficiency of the doctor, who can quickly find out patient status without visiting the hospital.

- A link to the hospital's outpatient services would allow rapid reporting of x-ray and laboratory results at the ordering physician's office.

New "health information services" businesses will emerge to conform to the changing sites of health care delivery; examples include hospitals tying physicians' offices to their data processing systems. Hospitals will also begin communicating and sharing data with off-site clinics, physician groups, or other alternate locations such as surgical/emergicenters within the next three years. The hospital information system will be at the center of a community medical information network linking physicians' offices, independent laboratories, nursing homes, therapists, pharmacists, and other health care providers.

General Electric has devised an electronic document exchange network to link hospital computers with those of insurance companies, thereby saving money.

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- An organization called NEIC (National Electronic Information Corporation), has signed on to use GE's network. Owned by 11 insurers, NEIC coordinates the exchange of claims data among 46 insurance companies and 350 hospitals.

The electronic transfer of medical claims allows physicians to contact the insurance company electronically, speeding up payment. Since insurance companies want doctors to transmit insurance forms electronically, doctors are buying computers.

The time is not far away when most claims will be electronically transmitted to third-party carriers. It is likely that carriers will mandate that claims be submitted to them in some electronic form.

C

Other New Applications

The new systems, functions, and features which have been introduced to the medical market recently, and will continue to grow rapidly, include:

- Electronic claims transmission.
- Cash flow and receivables management.
- Software programs for decision support, modeling, planning, and market share analysis.

As the number of hospitals continue to decrease, new types of delivery systems will emerge to take their place, such as ambulatory care centers, home health care, etc. These new delivery systems will provide new markets and new opportunities for information systems providers.

The dramatic increase in the number of HMOs, emergency clinics, and laboratories offers opportunities for information service vendors. With continued rapid growth rates forecast throughout the 1990s, HMOs represent one of the most lucrative growth segments in the health care industry.

- Managing an HMO organization requires a comprehensive, interconnected management system. HMOs will pay a premium for information and management tools that provide this capability. Vendors who possess these systems will be the likely survivors in this industry.

- HMOs will be seeking state-of-the-art management information systems providing immediate feedback on plan operations.

Medical records departments, which are trying to understand their case mix, must now look at data in a number of different ways to do trend analyses.

There will be openings for software that uses artificial intelligence, such as software that assists MDs with patient diagnosis. Clinical decision-

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making aids, pattern recognition systems and rule-based expert systems are emerging. Currrently, only a few are being marketed commercially, but there will be a number of AI products introduced in 1988, and these markets will be building rapidly in the next few years.

- To compare physicians' practice patterns and their attendant costs, hospitals must be able to merge financial data with patient care data, then analyze it.

One of the major requirements now and in the future is for hospitals to have reliable and timely information on which to run the business. Historically, government funding was reimbursement-based, and hospital software needed only to tally patient expenditures. Now, hospitals must be able to calculate costs.

The government's role in controlling hospital payment systems will no doubt increase, resulting in ever more complex reimbursement plans. Thus, there will be greater demand for detail-oriented, lower-cost analytical systems.

The federal government's Health and Human Services (HHS) Department is trying to impact doctors just as it did hospitals. HHS is considering ways to throw out cost-based reimbursement in favor of approaches that reward more efficient practitioners. One possibility is "DRGs for Doctors," in which Medicare would pay physicians for anesthesiology, radiology, surgery, and other services performed in a hospital setting—some 60% of Medicare's expenditures—on an average-cost basis. If this happens, it would create a large, new demand for computer systems that could handle these calculations.

An ancillary area recently addressed by computer systems is the operating room. A variety of operating room systems have begun to be installed, which use fourth generation language and windowing concepts to assist in operating room scheduling, inventory control, and other forms of operating room procedural tracking.

Improved automation is required in the following health care management areas:

- Operational cost data.
- Government reimbursement guidelines.
- Personnel cost data.
- Patient care data.
- Customer demographic data.

There is a definite trend toward bringing computing to the bedside of the patient not only for nursing, but for the physician. Such systems can be thought of as electronic clipboards to help automate and simplify the

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clerical functions in patient care. In the near future, it is anticipated that each bedside will have terminals to aid in patient monitoring and diagnosis. These bedside terminals could eventually replace many manual physician orders, medical records, and nurses' notations through voice recognition data entry.

In the short term, online data bases for medical information hold a great deal of promise. In the longer term, these services will be negatively impacted by the introduction of medical databases on CD-ROMs.

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Conclusions and Recommendation

Conclusions and Recommendations

In a market-driven health care environment, the challenge is for information service providers to organize so that they can quickly respond to changes in the market.

Serious vendors must begin to provide a full line of integrated financial, patient care, clinical and ancillary systems to accommodate the needs of all sizes of hospitals. Also of increasing importance is the need for vendors to move outside of the hospital by providing systems to a wider variety of medical provider functions and locations. Tying these separate entities into a network will provide a valuable market position to vendors.

All of today's leaders in the market developed their products in an era of "cost-plus" medicine. These established vendors are at risk to the extent that they cannot respond to a changing market. A new vendor developing new hardware or software may be able to develop a product that will outperform a system built for another era and subsequently modified.

The most promising products and services will be those designed to reduce costs or improve productivity. Systems will have to improve productivity or reduce costs. In an era of increasingly fixed costs, with no one to whom cost overruns can be passed.

Healthcare systems of the future will become increasingly complex as emphasis rises on cost containment through information management, and the number of participating physicians, clinics, hospitals, and patients increases.

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Appendix:
Forecast Data Base

Appendix: Forecast Data Base

This appendix Contains the following forecast information, as shown in Exhibits ME-1 through ME-4:

- Market size by delivery mode for each year 1986-1992.
- Market growth rates for 1986-1987.
- Average annual growth rate (AAGR) for each delivery mode for the five-year period 1987-1992.

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EXHIBIT ME-1

MEDICAL INDUSTRY SECTOR— INDUSTRY-SPECIFIC USER EXPENDITURE FORECAST, 1986-1992

SEGMENTATION BY DELIVERY MODE	1986 ($M)	1986-1987 Growth (%)	1987 ($M)	1988 ($M)	1989 ($M)	1990 ($M)	1991 ($M)	1992 ($M)	AAGR 1987-1992 (%)
Processing/ Network Services									
Remote Computing/ Batch	719	18	847	999	1,169	1,356	1,560	1,805	16
Facility Management	383	15	442	504	569	643	721	811	13
Total Processing Services	1,102	17	1,289	1,503	1,738	1,999	2,281	2,616	15
Application Software									
Mainframe/Mini	389	25	486	593	712	840	974	1,112	18
Micro	78	38	108	141	178	217	258	304	23
Total Application Software	467	27	594	734	890	1,057	1,232	1,416	19
Turnkey Systems	560	13	633	707	787	866	944	1,019	10
Professional Services	252	25	314	376	460	561	690	848	22
Sector Total	2,381	19	2,830	3,320	3,875	4,483	5,147	5,899	16

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EXHIBIT ME-2

MEDICAL INDUSTRY SECTOR—HOSPITALS INDUSTRY-SPECIFIC USER EXPENDITURE FORECAST, 1986-1992

SEGMENTATION BY DELIVERY MODE	1986 ($M)	1986-1987 Growth (%)	1987 ($M)	1988 ($M)	1989 ($M)	1990 ($M)	1991 ($M)	1992 ($M)	AAGR 1987-1992 (%)
Remote Computing	569	18	672	781	906	1,052	1,222	1,418	16
Facility Management	345	15	398	449	508	574	648	732	13
Total Processing Services	914	17	1,070	1,230	1,414	1,626	1,870	2,150	15
Application Software									
Mainframe/Mini	322	25	405	497	597	705	814	905	17
Micro	47	36	64	86	110	132	152	172	22
Total Application Software	369	27	469	583	707	837	966	1,077	18
Turnkey Systems	431	13	487	544	605	663	717	765	9
Professional Services	201	25	251	298	364	442	543	666	21
Sector Total	1,915	19	2,277	2,655	3,090	3,568	4,096	4,658	16

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EXHIBIT ME-3

MEDICAL INDUSTRY SECTOR—PHYSICIAN INDUSTRY-SPECIFIC USER EXPENDITURE FORECAST, 1986-1992

SEGMENTATION BY DELIVERY MODE	1986 ($M)	1986-1987 Growth (%)	1987 ($M)	1988 ($M)	1989 ($M)	1990 ($M)	1991 ($M)	1992 ($M)	AAGR 1987-1992 (%)
Remote Computing	135	16	157	197	239	277	307	351	18
Facility Management	30	17	135	45	49	55	57	61	12
Total Processing Services	165	17	192	242	288	332	364	412	15
Application Software									
Mainframe/Mini	52	21	63	74	89	105	123	163	20
Micro	27	41	38	48	59	74	93	116	25
Total Application Software	79	28	101	122	148	179	216	279	21
Turnkey Systems	112	13	127	142	159	178	199	223	12
Professional Services	43	23	53	66	81	101	125	155	24
Sector Total	399	19	473	572	676	790	904	1,069	15

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EXHIBIT ME-4

MEDICAL INDUSTRY SECTOR—OTHER INDUSTRY-SPECIFIC USER EXPENDITURE FORECAST, 1986-1992

SEGMENTATION BY DELIVERY MODE	1986 ($M)	1986-1987 Growth (%)	1987 ($M)	1988 ($M)	1989 ($M)	1990 ($M)	1991 ($M)	1992 ($M)	AAGR 1987-1992 (%)
Remote Computing	15	20	18	21	24	27	31	36	15
Facility Management	8	15	9	10	12	14	16	18	15
Total Processing Services	23	17	27	31	36	41	47	54	15
Application Software									
Mainframe/Mini	15	20	18	22	26	30	37	44	20
Micro	4	38	6	7	9	11	13	16	21
Total Application Software	19	25	24	29	35	41	50	60	20
Turnkey Systems	17	13	19	21	23	25	28	31	10
Professional Services	8	25	10	12	15	18	22	27	22
Sector Total	67	19	80	93	109	125	147	172	17

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